Well Completion & Hydraulic Fracturing

DJ BASIN, CO

In the DJ Basin, natural gas is produced from the J Sand, Codell, and Niobrara formations at depths ranging from approximately 7,000 feet to 8,500 feet below the ground's surface. After a well has been drilled to its total depth and before well completion activities begin, we:

- Install wellhead equipment to regulate and control gas flow;
- Run electric line logs of the well to identify specific gas-producing zones;
- Set steel production casing to the total well depth and cement it in place to a depth above the highest known gas bearing zone. The steel casing and cement stabilize the wellbore and isolate gas-producing zones from shallower water-producing zones.
- Run electric cement bond logs on the well to determine the cement quality and the depth of the top of the cement.

WHAT STEPS ARE REQUIRED TO COMPLETE A WELL?

Approximately 1-3 weeks after the drilling rig is removed, a second period of activity to complete the well takes place. The following steps occur to complete the well:

1. Perforating the casing and cement: A cylindrical perforating tool containing several high energy jet charges is lowered to the desired depth and detonated using electrical signals. Once detonated, these high energy jet charges penetrate the steel casing and cement sheath surrounding the casing. These "jet charges," about the size of the index finger, penetrate the very dense, hard rock formation only a few inches. This process creates a pathway for the gas to flow from the reservoir into the well's production casing.
2. Fracing the well (hydraulic fracturing): Virtually every gas well drilled today requires some type of stimulation to increase the gas flow to the wellbore. The goal of fracing (rhymes with "cracking") is to create long, narrow cracks to serve as a flow channel for gas trapped in the tight sands of the J Sand, Codell, and Niobrara formations. The sands are tightly compacted rock, the consistency of hardened cement.
3. Drilling out the plugs: Temporary bridge plugs are placed in the wellbore between each gas producing zone before fracturing. After fracing is completed, a smaller rig drills through the plugs and allows gas to flow through the perforations and up the steel casing.
4. Flowing back: After the plugs have been drilled out, the well is allowed to flow naturally. Initially, water, plug material and trace amounts of sand flow with the gas to the surface. The majority of water is collected and recycled.

WHAT IS FRACING?

To begin the fracture stimulation or fracing process, a perforating tool is run in the wellbore and set adjacent to the zone of interest. The tool is activated using electrical signals and high energy jet charges are detonated which penetrate the steel casing and cement sheath surrounding the casing. These "jet charges," about the size of the index finger, penetrate the very dense, hard rock formation only a few inches. Hydraulic fracturing is the process through which a fluid (typically a mix of water, sand and a small amount of fluid additives) is pumped down the wellbore under high pressure for short periods of time into geological formations that contain natural gas. The geologic formations that EnCana fracs in the Piceance Basin are generally located from 5,000 to 7,000 feet deep – often more than a mile below the surface. After fracturing, a crew runs tubing into the wells to enhance production by creating a more efficient path for natural gas to travel to the surface. While more than 94% of what we produce is natural gas we do recover some by-products or condensate, hydrocarbons that are in a gaseous state but condense into liquid as they travel up the wellbore and reach surface conditions. The flow of natural gas is controlled by a series of valves and instruments at the top of the well.

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HOW IS WATER PROTECTED?

Once the well is drilled, steel casing is placed to the total depth of the well and cemented into place to the top of the well for the purpose of protecting groundwater. The steel casing and cement stabilize the wellbore and isolate gas-producing zones from water-producing zones.

WHAT EQUIPMENT AND MATERIALS ARE REQUIRED FOR FRACING? ARE MATERIALS RECYCLED?

The following equipment and materials are required on-site during a typical frac job:

- 6 pump trucks
- 1 command center (truck/trailer)
- 1 blender truck (for sand and water)
- 2 sand containers (trailer size)
- 1 chemical storage unit
- 1 fuel truck
- 20,000 barrels (or more) of water stored in the existing frac pit and/or temporary tanks located on-site.

Fracing requires approximately 500,000 pounds of fine-grain silica sand and 1.2 million gallons of water per well. This equates to about 13 truckloads of sand, and 220 truckloads of water per well. However, we continuously recycle the water so that each additional well on a pad requires fewer truckloads of water.

On average, 60-70% of the water used during a frac job is recovered as the well begins to flow gas. EnCana reuses and recycles all of the recovered water on-site as each well is completed, and then trucks the water to other pads for use in completion activities.

HOW LONG DOES IT TAKE TO COMPLETE A WELL?

On average, it takes two days to frac each well and EnCana typically drills 2-4 wells per pad. A 15-man crew generally works from dawn to dusk, 5 to 6 days per week. From the time the drilling rig leaves the site to the point when the wells are completed and placed "on production," approximately 55 days elapse.

IMPACTS/MITIGATION

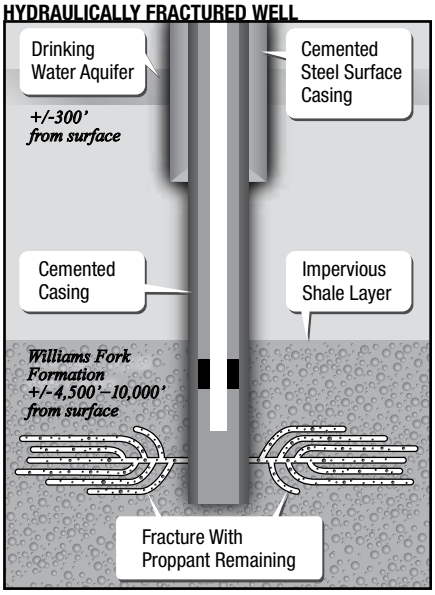
The most noticeable impacts of fracing are traffic and noise. EnCana works to minimize these disturbances and to address environmental concerns, often going above and beyond industry standards, by:

- installing sound-absorbing barriers
- redirecting lights after dark
- placing spill guards under all vehicles
- minimizing flaring, except when necessary for safety purposes
- with improvements in technology and equipment, we're striving for emissions free flowback operations
- constructing lined frac pits for on-site water storage where possible, to reduce truck traffic, hasten operations, and enhance recycling
- scheduling the frac stages as close together as possible, so each well can be fraced in the minimum amount of time needed
- treating frac water to prevent odors from bacteria, and draining all frac pits immediately after completion operations are finished on each pad
- utilizing existing infrastructure and temporary pipelines to increase ability to pump water to frac locations and minimize truck traffic

SAFETY

EnCana, other industry operators and residents alike want to ensure that underground drinking water sources are not impacted by drilling and completion processes. Studies find it highly unlikely that frac fluids can contaminate water wells, aquifers and other drinking water supplies. In the DJ Basin, gas-bearing strata and drinking water aquifers are separated by thousands of vertical feet of dense rock formations. While certain additives are used to enhance fracturing performance, the concentrations of these additives in the solution are minimal – especially given the quantity of water used in the fracing process.

HYDRAULICALLY FRACTURED WELL



For more information about well completion and hydraulic fracturing, see:

www.EPA.gov/safewater

Hydraulic Fracturing: A Primer
http://www.ipams.org/advocacy/reports_pdf

EnCana's Water Treatment Facility fact sheet

FOR MORE INFORMATION CONTACT:
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